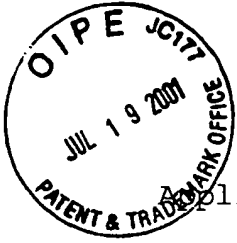


#2



PATENT
0104-0349P

IN THE U.S. PATENT AND TRADEMARK OFFICE

Applicant: Johan BERGSTRÖM Conf.:
Appl. No.: 09/886,482 Group: Unassigned
Filed: June 22, 2001 Examiner: UNASSIGNED
For: TAPE GUIDE AND MAGAZINE AT A COMPONENT
MACHINE

L E T T E R

Assistant Commissioner for Patents
Washington, DC 20231

July 19, 2001

Sir:

Under the provisions of 35 U.S.C. § 119 and 37 C.F.R. § 1.55(a), the applicant(s) hereby claim(s) the right of priority based on the following application(s):

<u>Country</u>	<u>Application No.</u>	<u>Filed</u>
SWEDEN	9804495-1	December 22, 1998
SWEDEN	9901057-1	March 23, 1999

A certified copy of the above-noted application(s) is(are) attached hereto.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fee required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

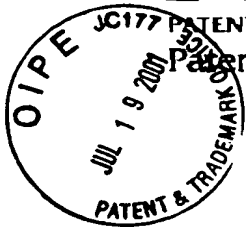
By Joe McKinney Muncy
Joe McKinney Muncy, #32,334

KM/PCL/gh
0104-0349P

P.O. Box 747
Falls Church, VA 22040-0747
(703) 205-8000

Attachment

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Patentavdelningen

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Attorney Pocket No. 0104-0349P
BERGSTROM, Johan
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Birch, Stewart, Kolasch & Birch, LLP
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Intyg Certificate

Härmed intygas att bifogade kopior överensstämmer med de handlingar som ursprungligen ingivits till Patent- och registreringsverket i nedannämnda ansökan.

This is to certify that the annexed is a true copy of the documents as originally filed with the Patent- and Registration Office in connection with the following patent application.

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Kerstin Gerdén
Kerstin Gerdén

Avgift
Fee 170:-

DEVICE AT A COMPONENT MOUNTING MACHINETechnical field of the invention

The present invention generally relates to the field of manufacture and assembly of circuit boards. More specifically it relates to a tape guide for guiding a carrier tape in a component mounting machine, a tape magazine for receiving the tape guide, and a system including the tape guide and the tape magazine.

Technical background and prior art

Generally, within the field of manufacture and assembly of circuit boards, electronic components are fed to a component mounting machine for mechanically and/or electrically mounting the components onto a circuit board. These surface mounted components are often delivered spaced apart along the length of a component tape, which consists of a lower carrier tape provided with compartments, one for each component, and an upper cover, or cover tape or protective tape. After the positioning of the electronic components in the corresponding compartments, the cover tape is attached to the carrier tape, for instance by providing either the cover tape or the carrier tape with adhesive areas, or by fusing the cover tape to the carrier tape, and the component tape is wound on a component reel. Then, the component reel is transferred to a component mounting machine, which feeds a component to a certain predetermined picking position where it can be picked, or collected, by a pick-up head. WO 86/00778 shows a cassette magazine for a component mounting machine using the above described method.

According to prior art, the loading of a component tape in a component mounting machine involves the following steps. Placing the component tape reel into the tape holder of a component mounting machine, or into a tape

magazine of a component mounting machine; introducing the free end of the component tape into a feeding mechanism, provided in the machine or in the magazine, such that feeding pins engage corresponding holes provided in the component tape; separating, by hand, the end of the cover tape from the end of the carrier tape for a distance sufficient to attach the cover tape to a cover tape handling means; bringing the cover tape end past a stripping edge which is combined with a plate or a locking mechanism that secures the carrier tape; lowering the locking mechanism over the carrier tape for holding the carrier tape against the feeding mechanism; bringing, by hand, the end of the cover tape, and attaching it, to the cover tape handling means; and stretching the cover tape, e.g. by manipulating the cover tape handling means.

Prior to the picking of the components, each component has to be exposed so as to make it available for picking. This is achieved by removing the cover tape from the carrier tape. The cover tape is then fed away by a separate cover tape handling means in order for the cover tape not to disturb the picking of components. Generally, the cover tape handling means comprises a winding hub on which the cover tape is wound. Additionally, when unloading the component tape from the component mounting machine, or the tape magazine, the winding hub has to be cleared of the cover tape.

A considerable length of the end of the cover tape has to be separated from the end of the carrier tape in order to bring the cover tape end to a cover tape handling means. Thus, the first decimetres of a new carrier tape are not provided with components. Otherwise, numerous components would be wasted during loading. However, when reloading a tape reel that already has been partly used, the tape is provided with components throughout, and consequently a large number of components may be wasted.

As realised from the above, the loading of a component tape in a component mounting machine is a time-consuming and complicated process that has to be performed every time a new component has to be added to the circuit board manufacturing process, negatively affecting the overall time efficiency of the manufacturing process and, hence, the overall costs. Additionally, when using a winding hub, or the like, for handling the cover tape, the required time for the loading process is even further increased, and the unloading of the component tape includes the additional step of clearing the winding hub of the cover tape. Furthermore, there is high risk of a considerable component waste with the loading method according to prior art.

Summary of the invention

It is therefore an object of the present invention to provide a solution to the problem of complicated and time-consuming loading of a carrier tape into a component mounting machine.

A further object of the present invention is to reduce the high number of wasted components when unloading/reloading a carrier tape from/into a component mounting machine.

These and other objects are achieved according to the present invention by providing a tape guide, a tape magazine and a system having the features defined in the independent claims. Preferred embodiments are defined in the dependent claims.

For the purpose of clarity, the term lateral refers to the lateral direction of the carrier tape. The terms distal and proximal refers to the direction opposite to and along the feeding direction of the carrier tape, respectively.

The present invention is based on the insight of providing a tape guide, for guiding a carrier tape in a component mounting machine, with the ability to be re-

leasably mounted such that the loading and/or unloading of a carrier tape can be performed away from the component mounting machine. Preferably, this is achieved according to the present invention by providing a tape
5 guide with locking means for readily attachment and detachment to interacting locking means in a component mounting machine, guiding means for guiding a carrier tape, and fixing means for fixing the carrier tape relative the tape guide.

10 By providing a tape guide with the ability to be loaded with a carrier tape away from a component mounting machine and to be subsequently loaded into the component mounting machine, a facilitated loading of the carrier tape into the machine, a reduced downtime of the machine,
15 and, thereby, an improved time efficiency of the entire manufacturing process is achieved. This is due to the fact that the time-consuming process of loading the carrier tape into a component mounting machine, as described above with reference to known art, is reduced to simply
20 placing a component tape reel into the tape holder of a component mounting machine, and mounting a tape guide into the machine. The rest of the loading process, comprising for example the steps of introducing the free end of the component tape into a feeding mechanism, separating,
25 ing, by hand, the end of the cover tape from the end of the carrier tape, bringing the cover tape end past a stripping edge, lowering the locking mechanism over the carrier tape, is performed beforehand and away from the component mounting machine. Thus, the downtime of the
30 component mounting machine due to the loading of a carrier tape is limited to the actual time for placing a tape reel into the machine, and for loading a tape guide into the machine.

35 The required features of the tape guide for enabling the loading of a carrier tape away from the machine and the subsequent loading of the tape guide, with the carrier tape, into the machine comprise locking means for

readily attachment of the tape guide into the machine, guiding means for correctly guiding the carrier tape into the machine, and fixing means for fixing the carrier tape relative the tape guide.

- 5 The locking means is provided for quick and accurate mounting of the tape guide into the component mounting machine. The locking means of the tape guide is arranged for interaction with corresponding locking means provided on the component mounting machine, thus providing both a
- 10 correct positioning and a secure mounting of the tape guide. Preferably, the locking means is in the form of resiliently biased snap-in locking means, e.g. in the form of a latch and a recess provided on the tape guide interacting with axles provided on the component mounting
- 15 machine, or in the form of a catch and an axle, respectively, provided on the component mounting machine interacting with corresponding protrusion and recess provided on the tape guide. As realised by a person skilled in the art, various types of snap-in locking means, or other
- 20 sorts of quick couplings, can be used for readily attachment and detachment of the tape guide into a component mounting machine.

- The guiding means is provided for guiding the carrier tape to the correct position within the component
- 25 mounting machine, such that the components to be picked by a picking head reaches the correct picking position. The guiding means is preferably in the form of opposing grooves extending from the distal end of the tape guide to the proximal end thereof.

- 30 The fixing means is provided for fixing the carrier tape such that the carrier tape is not displaced relative the tape guide, i.e. such that the tape guide can not move along the length of the carrier tape when the carrier tape has been loaded into the tape guide and before
- 35 attachment of the tape guide into, or after detachment of the tape guide from, the component mounting machine, i.e. when the tape guide with the carrier tape is located away

from the component machine. Thereby, following loading of the carrier tape into the tape guide, the tape guide can not be accidentally removed from, or moved along the length of, the carrier tape. This ensures that when loading the carrier tape into the tape guide, the desired position of the carrier tape relative the component mounting machine, and its parts, can be chosen. The chosen position is then maintained until the carrier tape is released from the tape guide.

10 According to an embodiment of the present invention, the release of the carrier tape can either be performed manually, preferably only when the tape guide and the carrier tape are located away from the component mounting machine, or automatically, preferably when the tape guide
15 with the carrier tape is mounted in the machine. According to said embodiment the fixing means comprises a pivoted lever, preferably spring-loaded. The lever is at one end provided with a locking pin that, when in use, engages a hole of the carrier tape, thereby keeping the
20 carrier tape at a position suitable for engagement by the feeding device. The lever is manually released during loading and unloading of the carrier tape into/from the tape guide, when the tape guide is located away from the component mounting machine, and is automatically released
25 when loading the tape guide, with or without a component tape, into the component mounting machine. The automatic release of the lever is achieved by the other end of the lever, opposite the end provided with the locking pin, being engaged by a part of the component mounting machine
30 during the attachment of the tape guide into the machine.

According to an alternative embodiment of the invention, the lever is provided with a friction lock instead of the locking pin described above.

As described above, the fixing means ensures that
35 the carrier tape is fixed relative the tape guide after removal from the component mounting machine, unless manually released. Thus, the tape guide may remain attached

and fixed to the carrier tape between the unloading and reloading of the tape guide. Thereby, there will be no additional removal of the cover from the carrier tape when reloading a carrier tape into the machine, and, hence, there will be no waste of components due to reloading of a carrier tape that already has been partly used. This will reduce the overall costs for the manufacturing process.

According to an embodiment of the present invention, the body of the tape guide is formed by an elongated open-ended profile with opposing elongated walls, and a base connecting said elongated walls. The walls are provided with the above described guiding means for guiding the carrier tape. The base is provided with an opening for enabling feeding means, provided in the component mounting machine or in an intermediate device attached to the machine, e.g. a tape magazine, to engage the carrier tape by protruding through the opening and engage feeding holes provided on the carrier tape. Thus, the tape guide does not comprise any feeding mechanisms at all, which significantly reduces the manufacturing costs for the tape guide.

According to specific embodiments of the invention, the tape guide is provided with means for exposing a component to be picked at a picking position. This exposure means could be in the form of a conventional winding hub interacting with a stripping edge for removing the cover covering the compartment containing the component to be picked, as described above with reference to prior art. The winding hub handles the cover after removal from the carrier tape to prevent the removed portion of the cover disturbing with the picking process. As obvious to a person skilled in the art, the winding hub could be replaced by any conventional exposure means contained in the known art, e.g. nip rollers.

According to a preferred embodiment of the invention, the exposure means comprises a separating device

for separating and lifting a lateral portion of the cover from the carrier tape, leaving the remaining portion of the cover at least partially attached to the carrier tape, and for bringing the lifted portion of the cover
5 aside such that the component to be picked can be exposed. A more detailed description of such a separating device will follow below.

The use of such a separating device eliminates the need for means handling the cover after removal from the
10 carrier tape since the cover remains attached to the carrier tape. Thereby, the loading process is even further facilitated and the loading time is reduced, reducing the downtime of the mounting machine and positively effecting the efficiency of the entire manufacturing process.

15 By arranging the separating device such that it covers a compartment, from the separating and lifting of the lateral portion of the cover until said compartment reaches the picking position, the number of components wasted is even further reduced. This is due to the fact
20 that the compartments containing the exposed components are covered by the separating device both when the tape guide with the carrier tape is mounted in the component mounting machine, and when the tape guide with the carrier tape is located away from the machine. This is accomplished by the feature of the fixing means, as de-
25 scribed above.

After the carrier tape has been loaded into the tape guide, the tape guide can be connected to the tape reel, according to an embodiment of the invention, by arranging
30 holding means on the tape guide for attachment of the tape guide to a tape reel. Thereby, the carrier tape reel can not be unrolled, and the tape reel can easily be stored together with the tape guide for quick mounting into a component mounting machine.

35 According to an embodiment of the invention, the holding means comprises a clip for attachment of the tape guide to a tape reel. According to an alternative embodi-

ment, the holding means comprises a piece of Velcro® on the tape guide engaging a corresponding piece of Velcro® provided on the tape reel. As realised by a person skilled in the art, various types of holding means is contemplated without extending beyond the scope of the present invention.

According to an aspect of the present invention, a tape magazine is provided for reception of at least one tape guide according to the invention, the magazine being provided with the corresponding locking means interacting with the locking means provided on the tape guide, said corresponding locking means otherwise being provided in the component mounting machine, as described above. The tape magazine is further provided with means for receiving at least one tape reel provided with a carrier tape, such that said reception can be performed when the carrier tape of the tape reel is loaded into the tape guide, and feeding means for feeding the carrier tape(s) towards the picking position. The tape magazine is coupled to, or mounted or attached to, the component mounting machine and forms an intermediate device between the tape guide, with the loaded carrier tape and tape reel, and the component mounting machine, and feeds the components to their respective picking position within the machine. For the purposes of the interaction between the tape guide and the component mounting machine, as described in the previous paragraphs with reference to the present invention, the component mounting machine can in these paragraphs be replaced by the tape magazine.

Further details and aspects of the invention will become apparent from the following detailed description of embodiments of the invention, reference being made to the accompanying drawings wherein like reference numerals refer to similar parts throughout.

Brief description of the drawings

Figure 1 is a schematic side view illustrating the principle of loading a component tape in a component mounting machine according to the state of the art.

5 Figure 2 is a top view illustrating the tape guide according to an embodiment of the invention.

Figure 3 is a perspective view illustrating the tape guide according to an embodiment of the invention.

10 Figure 4 is a cross sectional view of the tape guide shown in figure 3.

Figure 5 is a schematic illustration of the loading of a carrier tape according to the invention.

15 Figures 6a, 6b, 7 and 8 are schematic side views of tape guides and tape magazines according to alternative embodiments of the invention.

Figure 9 schematic view of a tape reel and the tape guide according to an embodiment of the invention.

Detailed description of preferred embodiments

20 With reference to figure 1, there is shown in schematic form the loading of a component tape into a component mounting machine according to the state of the art. A component tape 1, comprising a carrier tape 2, provided with compartments 3 filled with components 6, and a cover tape 4, is introduced into a feeding mechanism 8. The
25 pins of the feeding mechanism 8 engage corresponding holes 5 provided in the carrier tape 2. The end of the cover tape 4 is removed from the carrier tape 2 and wound onto a winding hub 50, which is provided with a separate feeding mechanism (not shown). The cover tape 4 is
30 brought past a first plate 54 provided with a stripping edge, and the cover tape 4 is stretched by a separate reel 52, applying pressure on the cover tape 4. A second plate 56 is provided after the first plate 54 for preventing small components 6, that can be electrostatically
35 adhered to the cover tape 4, from sticking to and following the removed portion of the cover tape 4 when said

portion is fed away. The second plate 56 extends to a position where the components 6 are picked by a pick-up head 7.

Referring to figures 2-4, preferred embodiments of a tape guide according to the present invention is illustrated. The tape guide 10 comprises an elongated open-ended profile 11 with opposing elongated walls 12, 13 provided with grooves 15, for facilitating insertion of a component tape 1 and for guiding the component tape 1, and a base 14 connecting the elongated walls 12, 13. The base 14 is provided with an opening 18 for enabling the pins of a feeding device 8, provided in the component mounting machine or in a tape magazine attached to the machine, to engage the holes 5 of the carrier tape 2. The tape guide 10 is further provided with a recess 17 (figure 3) positioned in the tape guide 10 at the picking position for facilitating picking of the components by the pick-up head 7.

The tape guide 10 is removably mounted to a component mounting machine, or a tape magazine and can be removed together with the component tape 1 when unloading the component tape 1 from the component mounting machine. To prevent the component tape 1 from being accidentally separated from the tape guide 10, when the tape guide 10 and the component tape 1 is not mounted to a component mounting machine, the tape guide 10 is provided with a fixing device 20 for fixing the component tape 1 relative the tape guide 10. The fixing device 20 consists of a spring-loaded pivoted lever 20, at one end provided with a locking pin 21, and a spring 23. When in use, the locking pin 21 engages a hole 5 of the carrier tape 2, thereby also keeping the carrier tape 2 at a position suitable for engagement by the feeding device 8. The lever 20 is manually released when loading and unloading the component tape 1 from the tape guide 10, when the tape guide 10 is located away from the component mounting machine, and is automatically released when loading the

tape guide 10, with or without a component tape 1, into the component mounting machine. A recess 22 is provided in the fixing device 20 for enabling said automatic release.

5 According to a specific embodiment of the present invention, shown in figure 2, the tape guide is provided with a separating device 30 for separating and lifting a lateral portion of the cover tape 4 from the carrier tape 2. The separating device 30 comprises a first section 31
10 and a second section 34, the first section 31 comprising a tip portion 32, positioned at the distal end of the separating device 30, and a body portion 33. The tip portion 32 extends distally from the body portion 33, has a laterally and vertically rounded shape, and has an in-
15 creased thickness in the direction extending backwards from the distal end of the tip portion 32. The tip portion 32 can be made from a rigid material and be rigidly or flexibly mounted. As an alternative, the tip portion 32 is produced from a flexible material, and is either
20 rigidly or flexibly mounted.

 The body portion 33 has a lateral extension in one direction only, the extension being sufficient to extend the body portion 33 beyond the lateral extension, or the side, of the cover tape 4. Further, the body portion 33
25 is elongated and has an extension in the proximal direction. Thus, the body portion 33 forms a cover plate preventing the exposure of each component 6 until said component 6 reaches the picking position. This will ensure that the components 6 can not escape from their respec-
30 tive compartments 3. Furthermore, the first section 31 prevents small components, that might be electrostatically adhered to the cover tape 4, from sticking to and following the lifted portion of the cover tape 4.

 The second section 34 is provided on the body portion 33 of the first section 31, and extends vertically
35 from, and essentially perpendicular to, the first section 31. According to this embodiment said sections 31, 34

constitute portions of a single, integral device 30. As an alternative, said sections 31, 34 can be separable.

The separating device 30, according to this embodiment, is particularly well suited for cover tapes that are provided with adhesive, or fused, areas 4a, 4b along the sides of the cover tape 4, as can be seen in figure 2. The separating device 30 is supported by the tape guide 10 that ensures that the carrier tape 2 is properly positioned relative the separating device 30 and the pick-up head 7. The separating device 30 is positioned such that the distal end of the tip portion 32 is positioned at the lateral centre of the cover tape 4, between the adhesive areas of the cover tape 4. According to this embodiment, the position and orientation of the separating device 30 is fixed relative the tape guide 20. As an alternative, the separating device 30 as a whole, or the second section 34 alone, can be adjustable in a horizontal plane, e.g. pivotable and/or movable in the lateral direction.

When feeding the carrier tape 2 in the feeding direction, as shown by the arrow in figure 2, the tip portion 32 separates and lifts the cover tape 4, at the lateral centre of the cover tape 4, from the carrier tape 2. The lateral extension of the body portion 33 to one side ensures that the corresponding side 4b of the cover tape 4 is separated from the carrier tape 2. The adhesive area 4a provided on the other side of the cover tape 4 is not affected by the separating device 30 and keeps that side of the cover tape 4 attached to the carrier tape 2. Following the separation of a portion of the cover tape 4 from the carrier tape 2, this portion is brought to an upright position, at least at the picking position, by the second section 34. Thereby, the components 6 are completely exposed at the picking position.

Referring to figure 5, there is shown in schematic form the loading of a component tape 1 into a tape guide 10 provided with a separating device 30 according to an

embodiment of the invention. A short portion of the end of the cover tape 4 has been separated from the carrier tape 2. The end of the carrier tape 2 is fed into the tape guide and brought past the distal end of the tip portion 32 of the separating device 30, enough to position said distal end in between the respective ends of the carrier tape 2 and the cover tape 4, and enough to allow a feeding mechanism to engage the carrier tape 2. The separated end of the cover tape 4 is then grasped and pulled in the feeding direction, thereby bringing the carrier tape 2 and the cover tape 4 past the distal end of the separating device 30.

Referring to figures 6a, 6b, 7 and 8, there is shown a tape reel 9, tape guides 10 and tape magazines 40 according to alternative embodiments of the invention. In figures 6a and 6b, there is shown a tape reel 9 provided with a component tape 1 that has already been loaded into the tape guide 10. The figures illustrate the quick loading of the tape guide 10 into a tape magazine 40 of a component mounting machine. The tape guide 10 according one embodiment is provided with locking elements in the form of a protrusion 25a and a recess 26 provided at opposite ends of the elongated tape guide 10. These locking elements interact with corresponding locking elements 45a, 46 in the form of a catch lock 45a and an axle 46 provided in the tape magazine 40. When loading the tape guide 10 into the magazine 40 the recess 26 first engages the axle 46, then the tape guide 10 is pivoted around the axle 46 such that the catch lock 45a goes into engagement with the protrusion 25a. Figure 6b shows the tape reel 9, the tape guide 10 and the tape magazine 40 after the tape guide 10 has been loaded into the magazine 40. For removal of the tape guide 10 from the tape magazine 40, the catch lock 45a has to be released.

Figure 7 shows an alternative embodiment similar to the embodiment of figures 6a and 6b wherein the catch lock 45a has been replaced by a resilient snap-in locking

element 45b. The loading of the tape guide 10 into the magazine 40 is similar to the loading procedure described above. Other locking elements for the tape magazine 40 are contemplated within the scope of the invention, for instance a latch or some other form of resilient locking means, preferably in a snap-in arrangement.

In a further embodiment shown in figure 8 the locking elements provided in the tape magazine 40 are rigid, here in the form of separate, spaced apart axles 45c, 46. The locking elements of the tape guide are in the form of a spring-loaded latch 25c and a recess 26. The loading of the tape guide 10 into the magazine 40 is similar to the loading procedure described with reference to figures 6a, 6b and 7. Other locking elements for the tape guide are contemplated within the scope of the invention, including both rigid and/or resiliently biased elements.

As can be seen in the figures 6a, 6b, 7 and 8 the tape magazine 40 is arranged for reception of the tape reel 9, as well as the tape guide 10. Preferably, a number of tape reels with corresponding tape guides can be received in a single tape magazine. The tape magazine is also arranged for reception of tape guides and tape reels of various widths. The width of the tape reels and tape guides are, of course, adapted to the width of the component tape, which depends on the contained component.

According to an embodiment of the present invention, the tape guide 10 is provided with holding means for attaching the tape guide 10 to the tape reel 9. An example of this is shown in figure 9. Here the tape guide 10 is provided with a clip 24 that ensures that the tape guide 10 is not accidentally separated from the tape reel 9 after the component tape 1 has been loaded into the tape guide 10. Thereby, the tape reel 9 can not be unrolled, and the tape reel 9 can easily be stored together with the tape guide 10 for quick mounting into a component mounting machine. In an alternative embodiment the holding means is a piece of Velcro® (not shown) for engage-

ment with a corresponding piece of Velcro[®] provided on the tape reel.

As apparent from this specification, the tape guide according to the invention can be directly mounted into a component mounting machine, or mounted into a tape maga-
5 zine, either when the tape magazine already is loaded into a component mounting machine or before loading of the tape magazine into a component mounting machine.

CLAIMS

1. A tape guide (10) for guiding a carrier tape (2) in a component mounting machine, the carrier tape (2) carrying components (6) positioned in sequence and covered by a cover (4), the tape guide interacting with feeding means (8) provided at the component mounting machine for feeding the carrier tape (2) towards a picking position, the tape guide (10) comprises locking means (25, 26) for enabling readily attachment and detachment of the tape guide (10) to the component mounting machine, guiding means (15) for guiding the carrier tape (2), and fixing means (20) for enabling the carrier tape (2) to be fixed relative the tape guide (10).
2. The tape guide (10) according to claim 1, wherein the tape guide (10) is formed by an elongated open-ended profile with opposing elongated walls (12, 13) provided with said guiding means (15) for guiding the carrier tape (2), and a base (14) connecting said elongated walls (12, 13).
3. The tape guide (10) according to claim 2, wherein the base (14) is provided with an opening (18) for enabling the feeding means (8) to engage the carrier tape (2) by protruding through the opening (18).
4. The tape guide (10) according to any one of the preceding claims, wherein said locking means (25, 26) is arranged for interaction in a snap-in arrangement with corresponding locking means (45, 46) provided in the component mounting machine.
5. The tape guide (10) according to claim 4, wherein the locking means (25, 26) comprises locking elements

spaced apart along the tape guide (10), at least one of said locking elements being a snap-in locking element, preferably resiliently biased.

- 5 6. The tape guide (10) according to claim 4, wherein the locking means (25, 26) comprises locking elements spaced apart along the tape guide (10), said locking elements being rigid.
- 10 7. The tape guide (10) according to any one of the preceding claims, wherein the fixing means comprises a spring-loaded pivoted lever (20).
- 15 8. The tape guide (10) according to claim 7, wherein the lever (20) is provided with a pin (21) for engagement with one of a number of feeding holes (5) provided on the carrier tape (2).
- 20 9. The tape guide (10) according to claim 7, wherein the lever (20) is provided with a friction lock.
- 25 10. The tape guide (10) according to any one of claims 7-9, wherein the lever (20) is manually releasable when the tape guide (10) is not mounted in the component mounting machine, and is automatically released when the tape guide (10) is mounted in the component mounting machine.
- 30 11. The tape guide (10) according to any one of the preceding claims, further comprising exposure means for exposing the components (6) at a picking position.
- 35 12. The tape guide (10) according to claim 11, wherein the exposure means comprises means for removing the cover (4) from the carrier tape (2), and means for handling the removed portion of the cover (4).

13. The tape guide (10) according to claim 12, wherein the means for handling the cover (4) comprises a winding hub.

5 14. The tape guide (10) according to claim 11, wherein the exposure means comprises a separating device (30) for separating and lifting a lateral portion of the cover (4) from the carrier tape (2), leaving the remaining portion of the cover (4) at least partially attached
10 to the carrier tape (2), and for bringing the lifted portion of the cover (4) aside.

15 15. The tape guide (10) according to claim 14, wherein the separating device (30) comprises a first section (31) for separating and lifting said lateral portion of the cover (4) from the carrier tape (2), and a second section (34) for bringing said lateral portion aside, said first section (31) being a front section comprising a laterally and vertically rounded tip portion (32) and a
20 body portion (33) extending backwards from the tip portion (32), said tip portion (32) having an increased lateral and vertical thickness in the proximal direction.

25 16. The tape guide (10) according to claim 15, wherein the tip portion (32) is laterally displaced from the lateral centre of the body portion (33).

30 17. The tape guide (10) according to claim 15 or 16, wherein said second section (34) comprises means for folding the lifted portion of the cover (4) completely to the side, thereby exposing the component (6).

35 18. The tape guide (10) according to any one of claims 15-17, wherein said first and second sections (31, 34) are separable.

19. The tape guide (10) according to any one of claims 15-18, wherein the separating device (30) is pivotable in a horizontal plane, or the second section (34) is pivotable in a horizontal plane or the second section (34) is laterally displaceable.

20. The tape guide (10) according to any one of claims 15-19, wherein said body portion is elongated and forms a cover plate preventing the exposure of each component (6) until said component (6) reaches the picking position, or wherein said second section (34) is elongated and forms a cover plate preventing the exposure of each component (6) until said component (6) reaches the picking position.

21. The tape guide (10) according to any one of the preceding claims, further comprising holding means for enabling attachment of the tape guide (10) to a carrier tape reel (9).

22. The tape guide (10) according to claim 21, said holding means being a clip (24).

23. The tape guide (10) according to claim 21, said holding means being a piece of Velcro®.

24. A tape magazine (40) for receiving at least one tape guide (10) according to any one of claims 1-23 and at least one reel (9) provided with a carrier tape (2) carrying components (6), wherein the tape magazine (40) is provided with corresponding locking means (45, 46) for engagement with the locking means (25, 26) provided on the tape guide (10), and a feeding device (8) for engagement with holes (5) on a carrier tape (2) guided by the tape guide (10) through an opening (18) provided on the tape guide (10).

25. The tape magazine (40) according to claim 24,
wherein the corresponding locking means (45, 46) com-
prises locking elements, at least one of which being a
snap-in locking element, preferably in the form of a
5 latch.

26. The tape magazine (40) according to claim 24,
wherein the corresponding locking means (45, 46) com-
prises rigid locking elements.

10

27. A system for providing components (6) to a com-
ponent mounting machine comprising at least one tape
guide (10) according to any one of claims 1-23, at least
one reel (9) provided with a carrier tape (2) carrying
15 components (6), and a tape magazine (40) according any
one of claims 24-26.

ABSTRACT

5 A tape guide (10) for guiding a carrier tape (2) in
a component mounting machine, a tape magazine (40) for
receiving the tape guide (10), and a system including the
tape guide (10) and the tape magazine (40). The carrier
tape (2) carries components (6) that are positioned in
sequence on the carrier tape (2) and are covered by a
10 cover tape (4). The tape guide (10) comprises locking
means (25, 26) for enabling readily attachment and de-
tachment of the tape guide (10) to the component mounting
machine, guiding means (15) for guiding the carrier tape
(2) towards a picking position, and fixing means (20) for
15 enabling the carrier tape (2) to be fixed relative the
tape guide (10).

Fig. 3

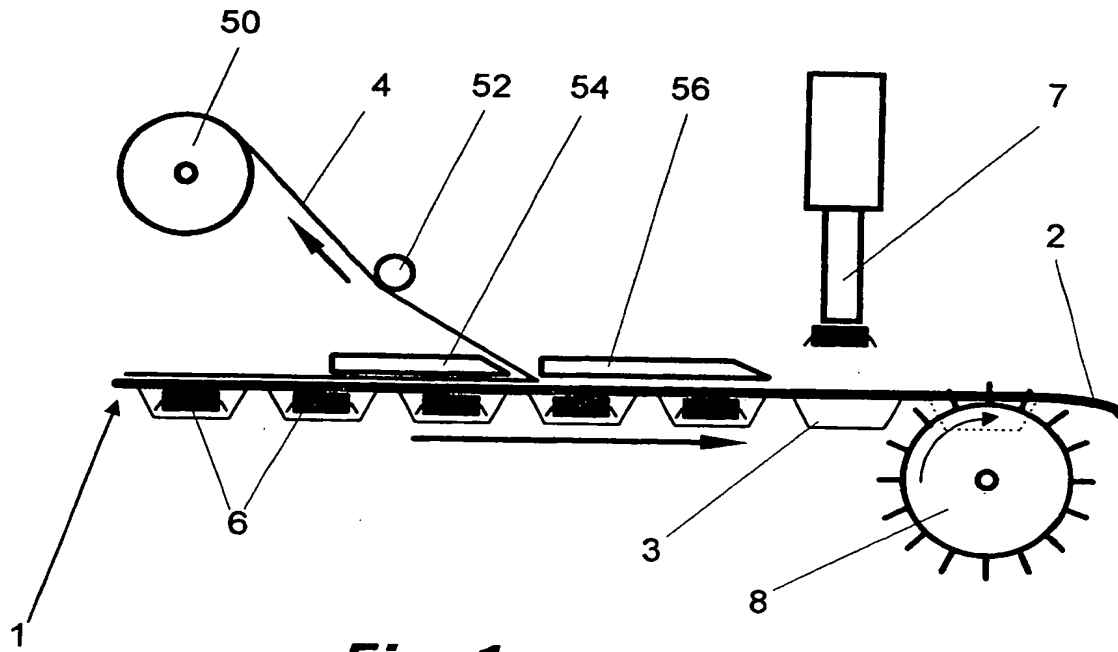


Fig. 1

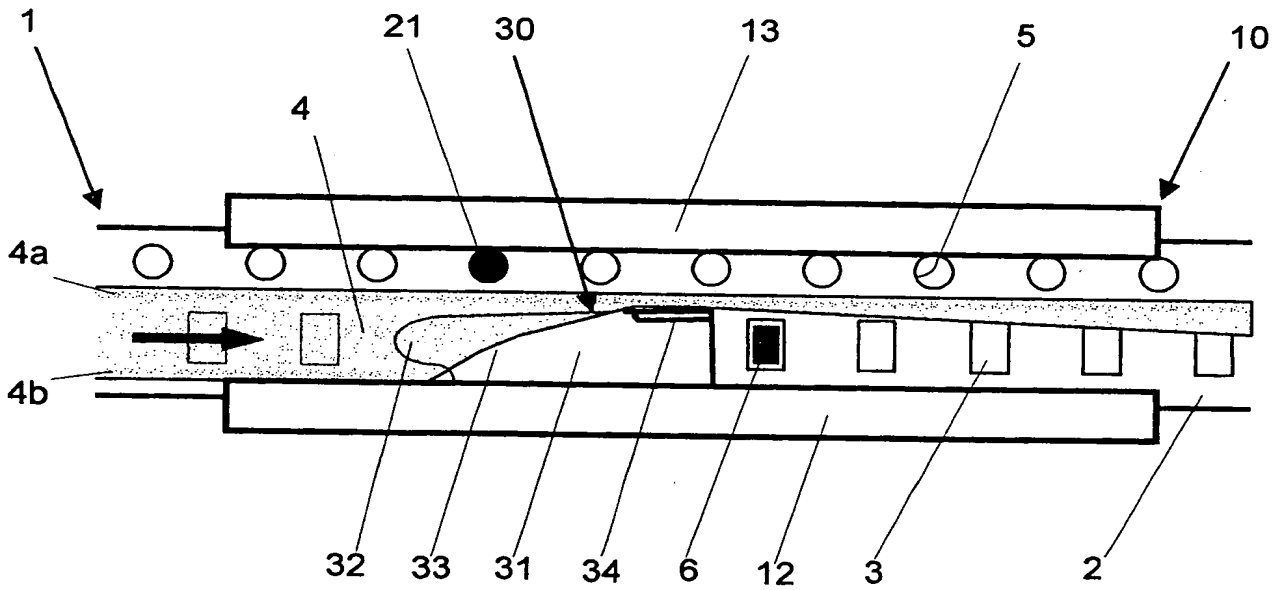


Fig. 2

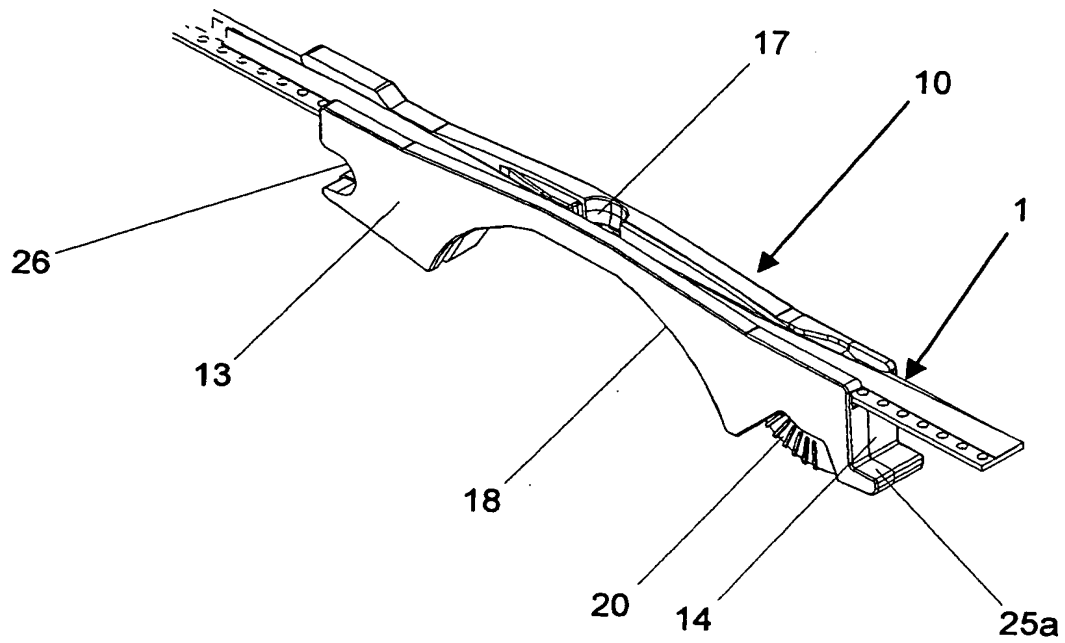


Fig. 3

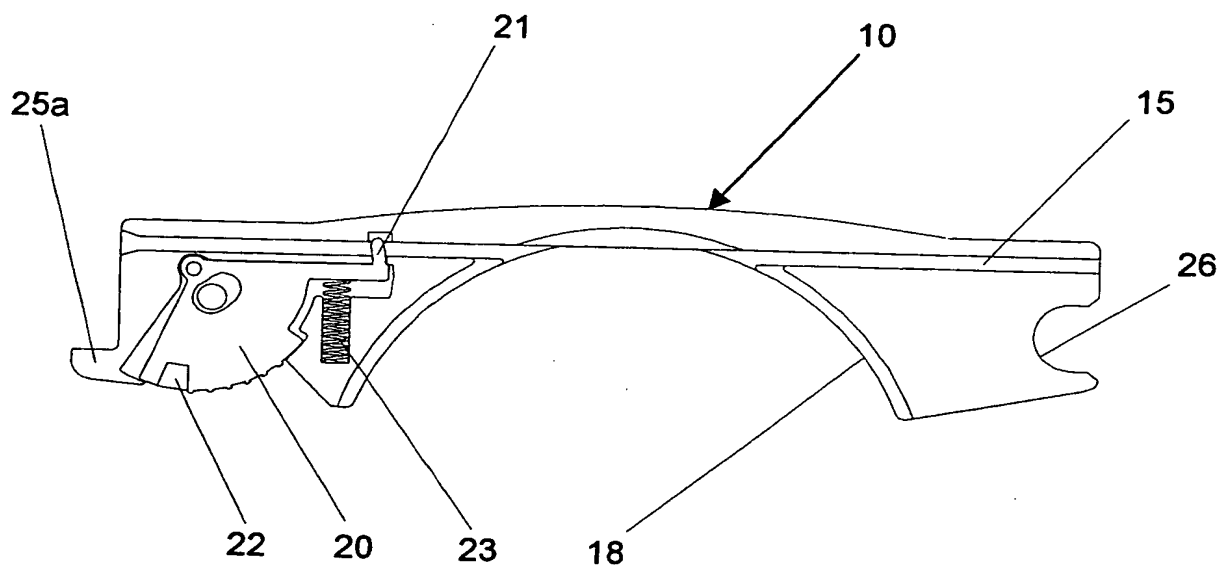


Fig. 4

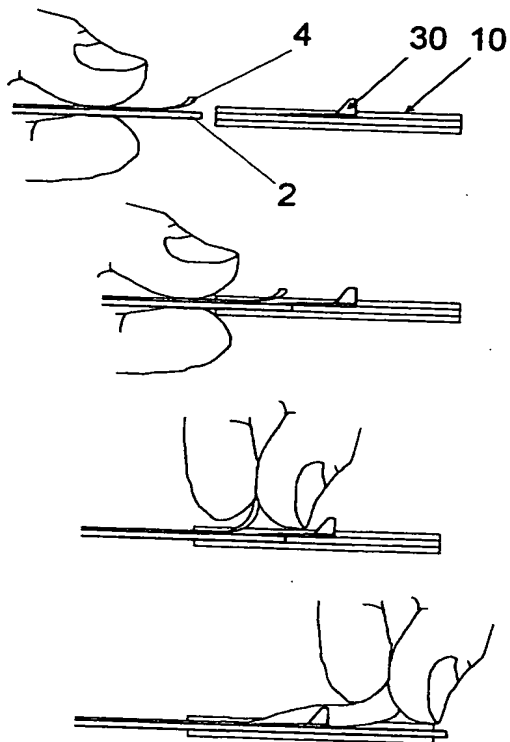


Fig. 5

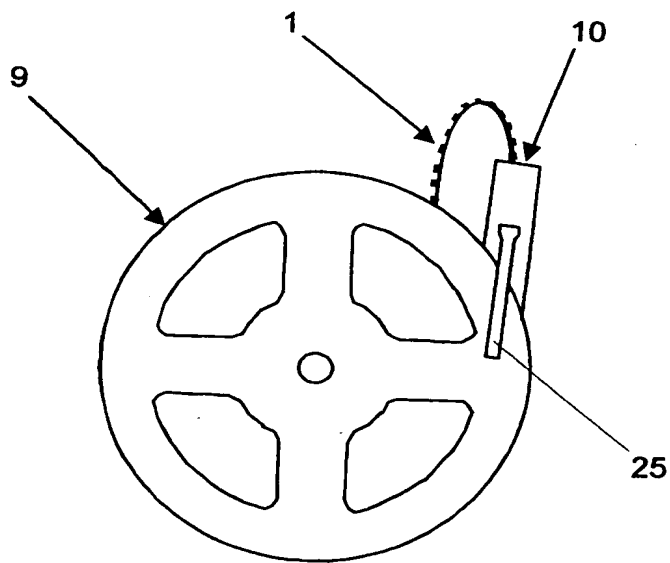


Fig. 9

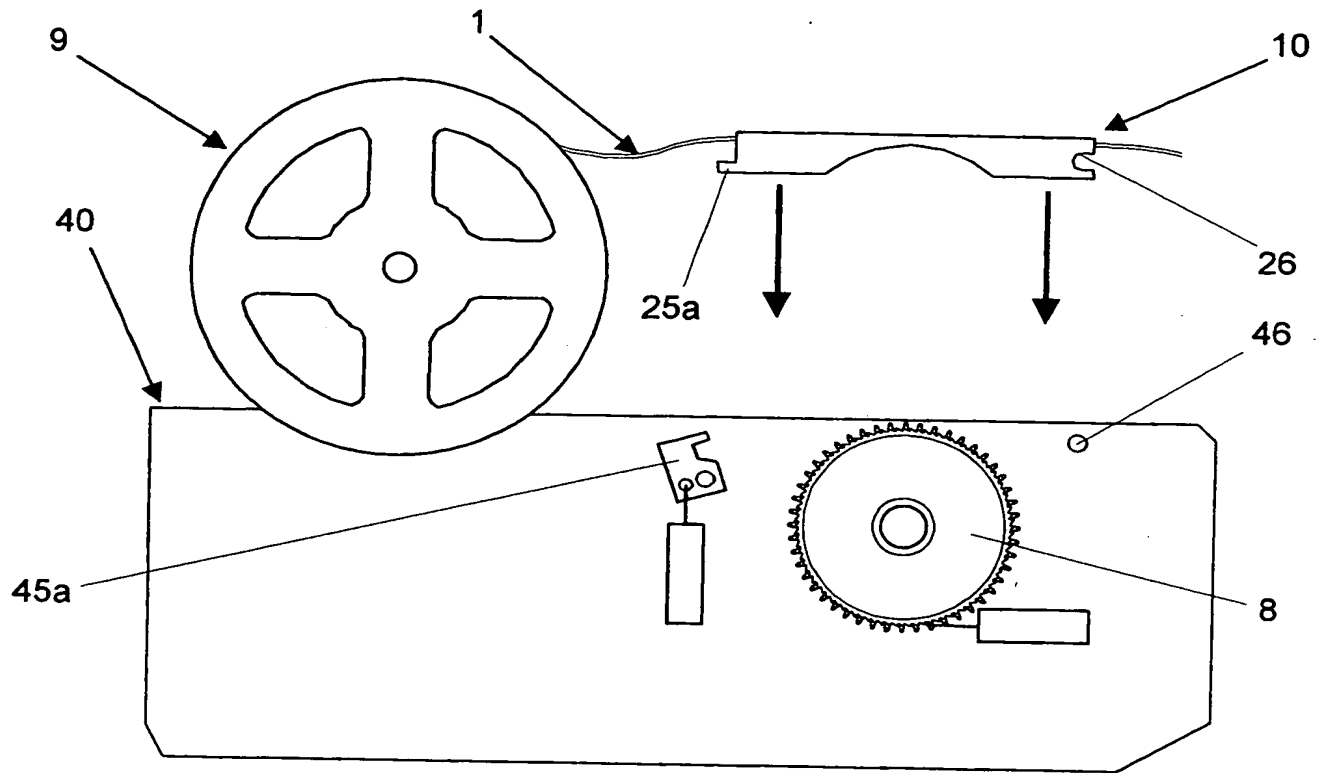


Fig. 6a

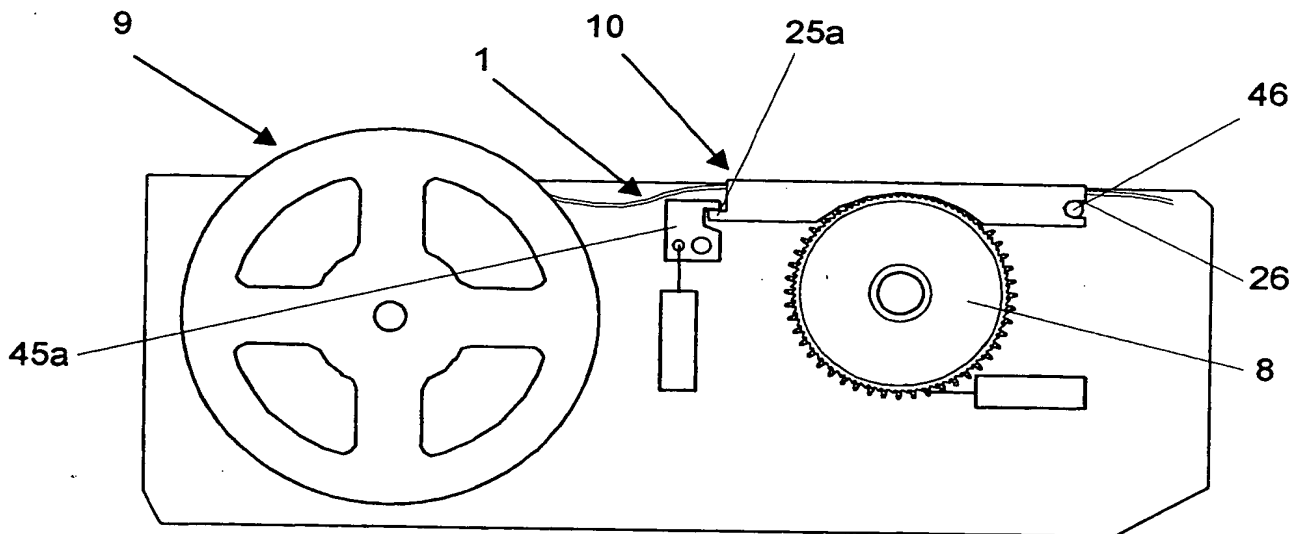


Fig. 6b

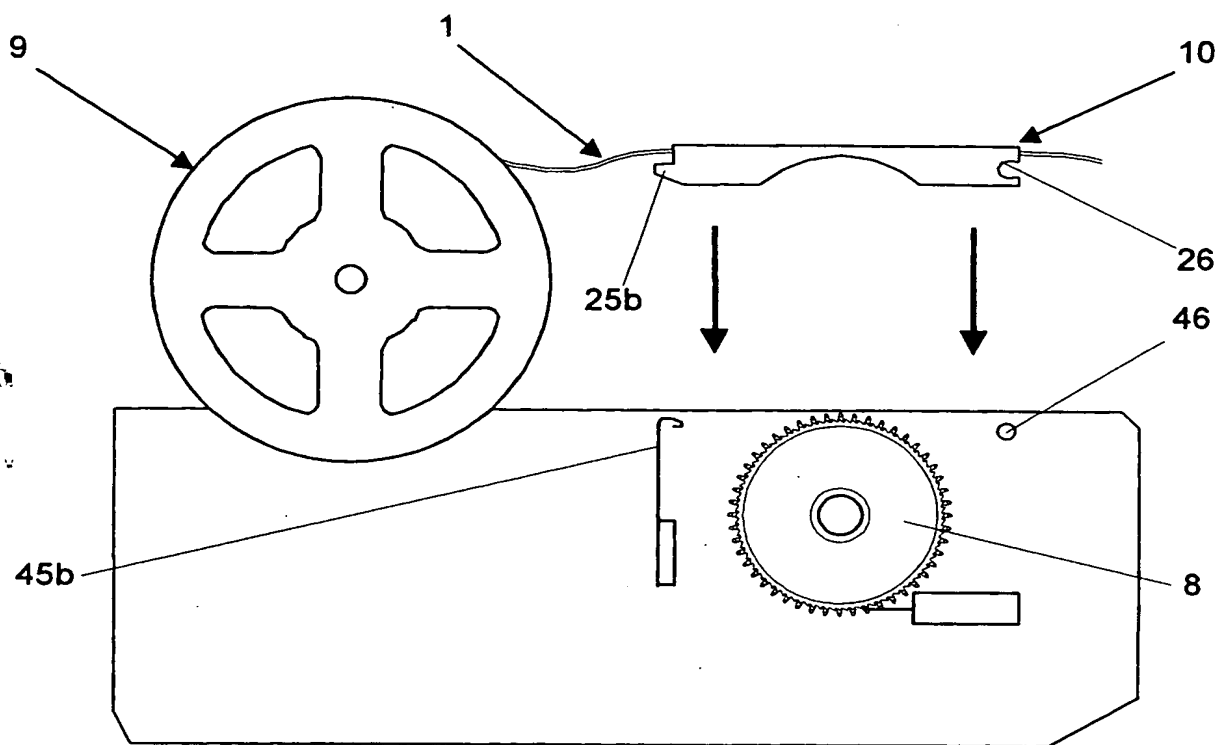


Fig. 7

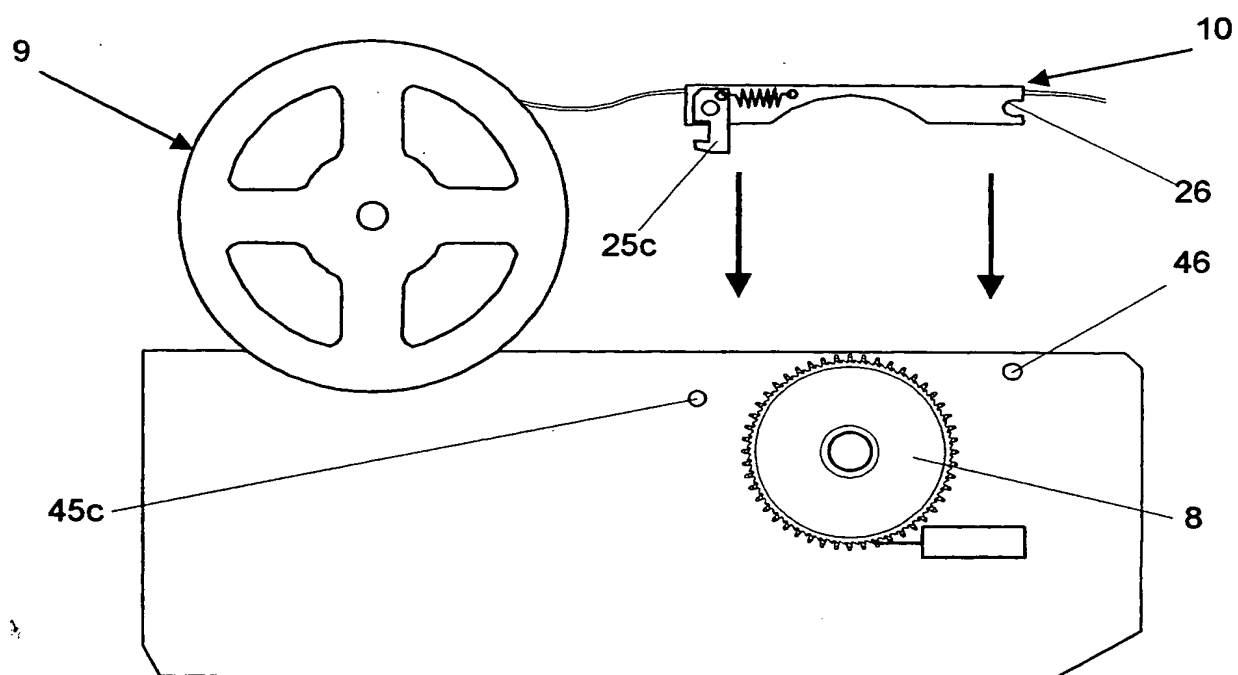


Fig. 8